APACHE HIGHLANDS NORTH

The Apache Highlands North Ecoregion spans 9.4 million acres in Arizona, largely comprised of grasslands, chaparral, and pinyon/juniper woodlands (Marshall and others 2004), but also containing significant mixed stands of Madrean evergreen oak woodlands and ponderosa pine/mixed conifer forests at higher elevations. Elevation ranges from about 2100 to 8800 feet, averaging about 4950 feet. Precipitation ranges from 10 to 18 inches in this ecoregion, with approximately equal portions falling in winter and summer. It contains a variety of landforms, including broad flat valleys, rolling hills, and steep mountains, including the isolated heights of the Hualapai Mountains, a "sky-island" landform similar to those of the Apache Highlands South. Precipitation in the "sky-island" areas to the south varies from 11 to 30 inches per year, with more precipitation at higher elevations and with slightly more falling in summer than winter.

The dominant characteristic of the Apache Highlands North is the highly dissected nature of the landform. With the Mogollon Rim defining the northern boundary of the eastern part of this ecoregion, the landforms consist in large part of canyons, valleys and the intervening small mountain ranges, ridges and plateaus. Relatively flatter and more extensive plateaus at somewhat higher elevation than the remainder of the ecoregion dominate the northwestern part of this ecoregion. This plateau country breaks into similarly highly dissected drainages and small mountain ranges towards the south.

The Apache Highlands North is transitional in nature throughout its extent. Dramatic local differences in elevation, slope and aspect may result in striking variety in habitat type and associated wildlife. Within a single square mile in this ecoregion it would not be unusual to encounter Great Basin Coniferous Woodland, Montane Coniferous Woodland, Chaparral, and Semidesert Grassland, as well as associated riparian and aquatic habitats.

The Apache Highlands North is a relatively well-watered portion of the State. Higher elevations to the north receive some of the most significant precipitation in the State, and much of that runoff flows through this ecoregion. The Salt River forms a portion of the southern boundary of this ecoregion and the Verde River bisects it. Other significant drainages include upper portions of the Big Sandy and Santa Maria rivers; the Agua Fria, and New River drainages; the Verde tributaries Sycamore Creek, Oak Creek, Beaver Creek, West Clear Creek, and the East Verde River; the Salt tributaries Tonto Creek, Cherry Creek, Canyon Creek, Cibeque Creek, Carrizo Creek, and the White and Black rivers; and the upper Gila River tributaries Bonita Creek, Eagle Creek and the San Francisco River. Many of the smaller tributaries of these named systems have perennial or intermittent flow, providing aquatic habitat, support for riparian communities and water for wildlife consumption. Additionally, private landowners and livestock operations have constructed numerous water impoundments across the breadth of this ecoregion that are of value to wildlife. The western third of the ecoregion is less well-watered. Moderately large portions of this western zone are covered by sagebrush and other Great Basin desertscrub species with Great Basin conifer forest occurring in the somewhat higher elevations with thinner soils and broken, rocky terrain. Significant canyon systems drain much of the north-central portion into the Colorado River through Cataract Canyon, with the north-western zone draining south and west to the Verde River through Big Chino and its tributaries.

Land management responsibility in the Apache Highlands North is predominantly tribal or federal in the eastern two-thirds of the ecoregion. The White Mountain Apache and San Carlos Apache Indian reservations lie at the eastern-most portion of the ecoregion. West of these, the USFS (Apache-Sitgreaves, Coconino, Tonto and Prescott national forests) is the principal land manager. Only small areas of private land are found within these zones, although the private lands are often some of the most well-watered and ecologically significant. Farther west in the ecoregion large areas of Arizona State Trust lands are present, often interspersed with private land in a checkerboard pattern. These offer a challenge to management since access and control are often limited. The BLM also manages a significant portion of lands in the western part of the ecoregion, and many BLM areas are similarly checkerboarded with State Trust and private land.

Due to the highly dissected nature of its topography, the more rugged areas of the Apache Highlands North are relatively less influenced by human population centers. Major communities in the ecoregion include Payson, Camp Verde, Cottonwood, Prescott, Prescott Valley, Kingman, Chino Valley, and Globe. Show Low and Pinetop-Lakeside straddle the border of this ecoregion and the Arizona-New Mexico Mountains. Because many of these communities are located in the large valleys of the ecoregion, where the topography is gentle and the soils are deeper, they have had a disproportionate influence on the condition of Plains and Great Basin Grassland landscapes, especially around Prescott, Prescott Valley, Kingman, and Chino Valley.

Mining, livestock grazing, and timber harvesting have been the dominant human economic activities throughout the Apache Highlands North Ecoregion since European settlement. Both activities have been a source of significant impacts on the biotic environment. Agriculture is present in the Verde Valley near Camp Verde and in other small valleys in the ecoregion, but is not of great significance anywhere.

Mining has led to establishment of human communities in the ecoregion, such as Globe and Clifton/Morenci, and has exerted lesser impacts in other localities. Many hills and canyons are dotted with working or abandoned small mines and claims. Some of these remain as blighted areas with negative impacts to wildlife and scenic value, while some mining structures provide habitat for bats and other wildlife with special habitat requirements.

Today, the Apache Highlands North is facing pressure from an increasing human population that finds the area's elevations and forests to be a highly desirable location to recreate. Indeed, this recreational use has an increasingly dominant impact on the landscape in this ecoregion. Many parts of this ecoregion get heavy recreational use from residents of the Phoenix metropolitan area. This and burgeoning retirement communities associated with the mild climate of the area create a population that is able to afford the time and expense to recreate in the outdoors. Human presence on the landscape is significant in all but the most inaccessible areas. Vehicular traffic on roads, tracks and trails creates disturbance to natural wildlife behaviors and movements. Lakeshores and streamsides have high levels of human presence during day use and overnight camping. Off-road travel by four-wheel drive vehicles, quads and dirt bikes has caused habitat

damage to plants and soils and high levels of disturbance to wildlife. The trend for all these types of disturbances continues to be on the increase.

Drought is a large source of negative impact on the habitats and wildlife of the Apache Highlands North. In winter 2005-06 Arizona find itself in an extensive period of severe drought, with little germination of winter annual vegetation and perennial vegetation dramatically reduced in vigor. Much of the existing vegetation has been severely over-utilized, in places due to wildlife use, but more extensively as a result of livestock grazing. Although the winter of 2004-05 provided a break in an overall 10-year pattern of drought, the effects of that year's precipitation are difficult to observe on the current landscape. Recent surveys of game species show little response in terms of reproduction (fawn:doe ratios) resulting from last year's rainfall, and total counts are down to historically low levels for many surveyed species. Habitat monitoring data is less readily available, but visual observations indicate severe loss of rangeland biomass, many springs and cattle tanks without water, and high levels of impact to vegetation and soils due to livestock that remain on rangelands.

Stressors described under each habitat type below reflect historical and continuing changes in ecological process as well as growth of human population centers in this ecoregion. Human developments have associated transportation and infrastructure requirements. For an expanded description of each habitat type and characterization of statewide threats to each, see "Statewide Condition of Arizona's Terrestrial and Riparian/Aquatic Habitat Types (Element 2)." See Appendix O for scoring of all stressors in each habitat type. The nature of these stressors in Arizona is presented more fully under "Stressors that Impact Wildlife and Wildlife Habitats (Element 3)." Finally, the descriptions provided do not attempt to depict conditions on sovereign tribal lands.

Species of Greatest Conservation Need (Element 1)

For more information on these species, see "Conservation Actions to Address Stressors to SGCN (Elements 3, 4)." A complete list of species, including those of lower conservation priority and of undetermined vulnerability status can be found in Appendix F. For some species in Table 16, this part of their distribution may not represent a key area for conservation actions.

Table 16. Tier 1a and 1b SGCN associated with each habitat type in Apache Highlands North.

Scientific name	Common name	Desert-scrub		Grass-lands		Woodlands/Forests					Aquatic & Riparian		
		Upland Sonoran	Mohave	Plains & Great Basin Semidesert		Interior Chaparral	Madrean Evergreen	Great Basin Conifer	Petran Montane Conifer	Human-dominated landscapes*	Streams/ Rivers	Wetlands/ Springs	Lakes/ Reservoirs
Amphibians													
Bufo microscaphus	Arizona Toad	X	X	X	X	X	X	X	X		X	X	
Eleutherodactylus augusti cactorum	Western Barking Frog				X	X	X						
Rana chiricahuensis	Chiricahua Leopard Frog			X	X	X	X	X	X		X	X	X
Rana pipiens	Northern Leopard Frog			X	X		X		X		X	X	X
Rana yavapaiensis	Lowland Leopard Frog	X		X	X	X	X	X	X		X	X	X
Birds													
Accipiter gentilis atricapillus	Northern Goshawk					X	X	X	X		X	X	X
Aechmophorus clarkii	Clark's Grebe									X	X	X	X
Ammodramus bairdii	Baird's Sparrow			X	X								
Ammodramus savannarum perpallidus	Western Grasshopper Sparrow			X	X					X			
Anthus spragueii	Sprague's Pipit			X	X								
Ardea alba	Great Egret									X	X	X	X
Botaurus lentiginosus	American Bittern									X	X	X	X
Buteo regalis	Ferruginous Hawk			X	X			X		X			
Buteogallus anthracinus	Common Black-Hawk					X	X		X		X	X	X
Catharus ustulatus	Swainson's Thrush					X	X	X	X	X	X	X	
Ceryle alcyon	Belted Kingfisher									X	X	X	X
Charadrius alexandrinus nivosus	Western Snowy Plover									X			X
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	X					X	X		X	X	X	X
Contopus cooperi	Olive-sided Flycatcher	X	X	X	X	X	X	X	X	X	X	X	X
Dendrocygna autumnalis	Black-bellied Whistling-Duck									X			X
Dumetella carolinensis	Gray Catbird									X	X	X	X

Table 16. Tier 1a and 1b SGCN associated with each habitat type in Apache Highlands North.

Scientific name	Common name	Desert-scrub		Grass-lands		Woodlands/Forests				Human-dominated landscapes*	Aquatic & Riparian		
		Upland Sonoran	Mohave	Semidesert Plains & Great Basin		Interior Chaparral	Madrean Evergreen	Great Basin Conifer	Petran Montane Conifer		Streams/ Rivers	Wetlands/ Springs	Lakes/ Reservoirs
Egretta thula	Snowy Egret									X	X	X	X
Empidonax traillii extimus	Southwestern Willow Flycatcher	X	X			X				X	X	X	X
Falco peregrinus anatum	American Peregrine Falcon	X	X	X	X	X	X	X	X	X	X	X	X
Haliaeetus leucocephalus	Bald Eagle							X	X	X	X	X	X
Ictinia mississippiensis	Mississippi Kite									X	X	X	
Oreoscoptes montanus	Sage Thrasher	X	X	X	X	X		X		X			
Pandion haliaetus	Osprey									X	X	X	X
Picoides dorsalis	American Three-toed Woodpecker												
Pinicola enucleator	Pine Grosbeak								X				
Progne subis arboricola	Western Purple Martin			X	X		X	X	X	X	X		X
Sphyrapicus nuchalis	Red-naped Sapsucker	X	X			X	X	X	X	X	X	X	X
Strix occidentalis lucida	Mexican Spotted Owl					X	X	X	X		X	X	
	Fish												
Agosia chrysogaster	Longfin Dace										X		
Catostomus clarki	Desert Sucker										X		
Catostomus insignis	Sonora Sucker										X		
Catostomus latipinnis	Flannelmouth Sucker										X		
Cyprinodon macularius	Desert Pupfish										X	X	
Gila elegans	Bonytail										X		
Gila intermedia	Gila Chub										X	X	
Gila nigra	Headwater Chub										X		
Gila robusta	Roundtail Chub										X		
Meda fulgida	Spikedace										X		
Oncorhynchus gilae apache	Apache (Arizona) Trout										X		X
Oncorhynchus gilae	Gila Trout										X		

Table 16. Tier 1a and 1b SGCN associated with each habitat type in Apache Highlands North.

Scientific name	Common name	Desert-scrub		Grass-lands		Woodlands/Forests				Human-dominated landscapes*	Aquatic & Riparian		
		Upland Sonoran	Mohave	Semidesert Plains & Great Basin		Interior Chaparral	Madrean Evergreen	Great Basin Conifer	Petran Montane Conifer		Streams/ Rivers	Wetlands/ Springs	Lakes/ Reservoirs
gilae													
Plagopterus argentissimus	Woundfin										X		
Poeciliopsis occidentalis occidentalis	Gila Topminnow										X	X	
Ptychocheilus lucius	Colorado Pikeminnow										X		
Rhinichthys osculus	Speckled Dace										X		
Tiaroga cobitis	Loach Minnow										X		
Xyrauchen texanus	Razorback Sucker										X		
Crustaceans and Mollusks													
Anodonta californiensis	California Floater										X	X	X
Oreohelix yavapai cummingsi	(blank)			X				X					
Pyrgulopsis glandulosa	Verde Rim Springsnail											X	
Pyrgulopsis montezumensis	Montezuma Well Springsnail											X	
Pyrgulopsis morrisoni	Page Springsnail											X	
Pyrgulopsis simplex	Fossil Springsnail											X	
Pyrgulopsis sola	Brown Springsnail											X	
Mammals													
Cynomys gunnisoni	Gunnison's Prairie Dog			X	X	X		X	X				
Euderma maculatum	Spotted Bat			X	X	X	X	X	X		X	X	X
Eumops perotis californicus	Greater Western Mastiff Bat		X	X	X	X		X	X				X
Lasiurus blossevillii	Western Red Bat	X				X		X	X		X	X	
Lasiurus xanthinus	Western Yellow Bat			X	X	X	X	X			X	X	
Macrotus californicus	California Leaf-nosed Bat		X		X	X	X	X			X	X	
Microtus mexicanus hualpaiensis	Hualapai Mexican Vole					X		X	X				
Mustela nigripes	Black-footed Ferret			X									
Nyctinomops	Big Free-tailed Bat					X	X	X	X		X	X	X

Table 16. Tier 1a and 1b SGCN associated with each habitat type in Apache Highlands North.

Scientific name	Common name	Desert-scrub		Grass-lands		Woodlands/Forests				Human-dominated landscapes*	Aquatic & Riparian		
		Upland Sonoran	Mohave	Plains & Great Basin Semidesert		Interior Chaparral	Madrean Evergreen	Great Basin Conifer	Petran Montane Conifer		Streams/ Rivers	Wetlands/ Springs	Lakes/ Reservoirs
macrotis													
Ovis canadensis mexicana	Desert Bighorn Sheep	X	X	X	X						X	X	
Panthera onca	Jaguar	X	X	X	X	X	X	X	X				
Perognathus flavus goodpasteri	Springerville Pocket Mouse			X									
Sigmodon arizonae jacksoni	Yavapai Arizona Cotton Rat			X									
Sorex arizonae	Arizona Shrew						X	X	X		X	X	
Zapus hudsonius luteus	New Mexican Jumping Mouse										X	X	
Reptiles													
Gopherus agassizii (Sonoran Population)	Sonoran Desert Tortoise	X	X		X	X		X					
Thamnophis eques megalops	Northern Mexican Gartersnake										X	X	X
Thamnophis rufipunctatus	Narrow-headed Gartersnake										X		

*Human-dominated landscapes here refer to agricultural areas and urban lakes. These habitat types are discussed under "Statewide Condition of Arizona's Terrestrial and Aquatic/Riparian Habitat Types," and in "Stressors to Arizona's Wildlife and Wildlife Habitat" under the stressor "Urban/rural development."

Habitat types below are arranged in order of prevalence in this ecoregion. Where patches of uncharacteristic habitat types (not described in this section) occur in this ecoregion, conservation should reflect stressors and species identified in neighboring ecoregions.

Great Basin Conifer Woodland

(37.7% of acreage)

Habitat Condition (Element 2)

This habitat type, characterized by alligator and one-seed juniper, exists throughout middle elevations of the ecoregion. This landscape and Interior Chaparral are the dominant vegetation types of this ecoregion. The condition of Great Basin Coniferous Woodland is that it is increasing in extent within this ecoregion at the expense of Semidesert Grassland and riparian

habitats. This reflects the combined impacts of altered fire regimes and intensive domestic livestock use over the past 100 years. Over the last 10 years, portions of this habitat type have been treated by various means to reduce overstory vegetation and to restore grassland. The resulting vegetative communities vary in composition, stability and productivity depending on restoration techniques employed and subsequent management practices. Presence of undesirable invasive plants has resulted in much of the treated acreage failing to be properly restored to the intended grasslands.

The important stressors listed below reflect impacts of these historical land uses as well as increasing human population and pressure for outdoor recreational opportunities for people living within the ecoregion and in neighboring metropolitan Phoenix.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: Abiotic resource use
Groundwater depletion and springhead use
Stressor Category: Changes in Ecological Processes
Insect Infestation
Habitat fragmentation/barriers
Loss of keystone species
Unnatural fire regimes
Stressor Category: Climate Change
Shift to warmer climate
Drought
Stressor Category: Consumptive use of biological resources
Grazing by ungulates
Stressor Category: Habitat conversion
Rural development
Livestock management
Stressor Category: Invasive species
Nuisance plants
Nuisance animals
Stressor Category: Non-consumptive resource use
Non-motorized recreation off-trail
Motorized recreation off-trail
Stressor Category: Pollution
Contaminants from waste water and runoff
Stressor Category: Transportation and infrastructure
Power lines/wind-harnessing turbines
Telephone lines/cellphone towers
Roads for motorized vehicles
Unauthorized roads & trails

Interior Chaparral
(21.8% of acreage)

Habitat Condition (Element 2)
This habitat type is co-dominant in this ecoregion with Great Basin Coniferous Woodland. Characterized by shrub live oak, manzanita, various *Ceanothus* and other shrubs, it forms nearly impenetrable thickets on many slopes in the area. Although this habitat has high value for wildlife, the current condition of much of the chaparral is decadent from decades of fire suppression. As a fire-adapted community, much of its value to wildlife occurs in the early seral stages. It is expected that this landscape is on course to experience a return to wildfires. This change in fire regime is expected due to climate and land management shifts. The ongoing drought and higher temperatures should increase the likelihood of fire. Recent changes in land management agency policies treat fire as a natural element in this landscape, leading to active use of fire as a management tool. Otherwise, historical land uses are largely limited to livestock grazing, with a small amount of recreation (hunting, fishing, hiking, off-highway vehicle use, etc.). These pressures will not change dramatically in the near term, although livestock grazing may start to decrease.

Water for wildlife in this landscape is often available only along major drainages and from springs and seeps in canyons and drainages. The current drought has eliminated available water from many of these sources, forcing wildlife to re-locate or perish and adversely affecting riparian plant communities. Large destructive fires have also had adverse affects by removing plant biomass protection to soils, resulting in erosive run-off.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: Abiotic resource use
Groundwater depletion and springhead use
Stressor Category: Changes in Ecological Processes
Loss of keystone species
Unnatural fire regimes
Habitat fragmentation/barriers
Soil erosion
Stressor Category: Climate Change
Shift to warmer climate
Drought
Stressor Category: Consumptive use of biological resources
Grazing by ungulates
Stressor Category: Habitat conversion
Rural development
Stressor Category: Invasive species
Nuisance animals

Nuisance plants
Stressor Category: Pollution
Contaminants from waste water and runoff
Stressor Category: Transportation and infrastructure
Power lines/wind-harnessing turbines
Roads for motorized vehicles
Telephone lines/cellphone towers

Semidesert Grassland
(14.3% of acreage)

Habitat Condition (Element 2)
This habitat type is most extensive in southerly portions of this ecoregion and at its lowest elevations. There are scattered patches of this habitat type in the northwest, with the largest blocks on the western edge. This is the habitat type in this ecoregion that has probably diverged most significantly from its native condition. This landscape was historically dominated by perennial bunch grasses such as three-awn, tobosa and grama species interspersed with low shrubs and bare ground. Because it is characterized by lower precipitation than other grasslands, its condition has been very susceptible to changes associated with human activities such as intensive livestock grazing, fire suppression, and growing human settlements. Bunch grasses have consequently been replaced in most areas with scrubby trees and shrubs and by annual grasses and forbs. The current condition of this habitat type is that it has been degraded throughout the ecoregion, followed by invasion of Great Basin Conifer and/or Upland Sonoran Desertscrub communities in degraded areas. Current drought, and expectation that it may continue for a significant period into the future, creates a mixed prognosis for this habitat. Increases in fire on this landscape offer an opportunity for the perennial grass community to reestablish a favorable equilibrium with the invading shrubs communities. However, without normal or near normal precipitation, grasses are unlikely to thrive. In addition, nonnative grasses and forbs are mostly annual species which react quickly to favorable conditions, sequester nutrients, and out-compete the native perennial grasses, at least in the short-term.

The stressors listed below reflect historical land uses, plus impacts from increasing human populations and recreational pressure. In its degraded state, it is more susceptible to invasion by nonnative herbs as well as native shrubs, both of which change the community composition and affect the success of restoration techniques.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: Abiotic resource use
Groundwater depletion and springhead use
Stressor Category: Changes in Ecological Processes
Habitat degradation/shrub invasions
Unnatural fire regimes

Soil erosion
Habitat fragmentation/barriers
Stressor Category: Climate Change
Drought
Shift to warmer climate
Stressor Category: Consumptive use of biological resources
Grazing by ungulates
Stressor Category: Habitat conversion
Urban growth
Rural development
Livestock management
Stressor Category: Invasive species
Nuisance animals
Nuisance plants
Stressor Category: Non-consumptive resource use
Non-motorized recreation off-trail
Motorized recreation off-trail
Stressor Category: Pollution
Contaminants from waste water and runoff
Stressor Category: Transportation and infrastructure
Roads for motorized vehicles
Unauthorized roads & trails
Power lines/wind-harnessing turbines
Telephone lines/cellphone towers

Plains and Great Basin Grassland
(13.9% of acreage)

Habitat Condition (Element 2)
These grasslands are situated on high plains, in valleys, and on adjacent low hillsides, ridges and mesas. Landscapes are dominated by perennial grasses and are usually composed of mixed or short grass communities. Once forming large uninterrupted expanses of continuous grassland, its current condition is characterized by large-scale shrub encroachment and loss of plant diversity. Many changes in structure and composition started over a century ago with the rise of livestock operations and subsequent loss of fire from the system. More recently, urban and rural development has encroached on this landscape. The condition of this habitat type is moderately to severely degraded with little prospect of reversal due to soil losses and invasion by nonnative grasses and woody species. Management is needed to reduce forage utilization by livestock and other ungulates to levels below rates of annual production. Allocation of this annual production demands continued and increased inter-agency coordination. Much of this coordination is not effective at present due to budgetary constraints on forage monitoring efforts.

Stressors described below reflect resulting changes in ecological process as well as impacts related to a trend toward a warmer climate, increased human population growth in this ecoregion and in neighboring metropolitan Phoenix.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: Abiotic resource use
Groundwater depletion and springhead use
Stressor Category: Changes in Ecological Processes
Habitat fragmentation/barriers
Unnatural fire regimes
Soil erosion
Habitat degradation/shrub invasions
Stressor Category: Climate Change
Shift to warmer climate
Drought
Stressor Category: Consumptive use of biological resources
Grazing by ungulates
Stressor Category: Habitat conversion
Livestock management
Urban growth
Rural development
Stressor Category: Invasive species
Nuisance animals
Nuisance plants
Stressor Category: Non-consumptive resource use
Non-motorized recreation off-trail
Motorized recreation off-trail
Stressor Category: Pollution
Contaminants from waste water and runoff
Stressor Category: Transportation and infrastructure
Telephone lines/cellphone towers
Power lines/wind-harnessing turbines
Roads for motorized vehicles
Unauthorized roads & trails

Montane Conifer Forest
(8.2% of acreage)

Habitat Condition (Element 2)
This habitat type, characterized by ponderosa pine and Gambel oak, exists as a band in the northeastern portion of the ecoregion and at the highest elevations within the rest of the ecoregion. A large zone of this habitat type occurs below the Mogollon Rim from about

Pine/Strawberry eastward to Pinetop-Lakeside. Much of this forest has been logged for timber, especially in the last century. Harvesting strategies over this period have shifted the condition from a patchwork of stands of variable age and composition to one that is in a modified, second-growth condition. Previous harvesting strategies resulted in even-aged, high stem density stands of primarily ponderosa pine. The modified structure of these forests renders them more vulnerable to hot, destructive fire and disease. In recent years, timber harvest has been much reduced and fire suppression strategies have been changed with the expectation that this will begin a trend towards more diverse forests. Extensive loss of trees and in some cases whole stands has occurred during the current drought period due to fire and to stress-related infestation by bark beetles and other insects. Stressors described below reflect resulting changes in ecological process as well as impacts related to human population growth in this ecoregion and in neighboring metropolitan Phoenix.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: Abiotic resource use
Groundwater depletion and springhead use
Stressor Category: Changes in Ecological Processes
Soil erosion
Habitat fragmentation/barriers
Loss of keystone species
Habitat degradation/shrub invasions
Insect Infestation
Unnatural fire regimes
Stressor Category: Climate Change
Shift to warmer climate
Drought
Stressor Category: Consumptive use of biological resources
Grazing by ungulates
Stressor Category: Habitat conversion
Forest and woodland management - habitat conversion
Rural development
Stressor Category: Invasive species
Nuisance plants
Disease/pathogens/parasites
Stressor Category: Transportation and infrastructure
Telephone lines/cellphone towers
Power lines/wind-harnessing turbines
Roads for motorized vehicles

Madrean Evergreen Woodland
(2.9% of acreage)

Habitat Condition (Element 2)

This habitat type is present primarily in small portions of the eastern part of the ecoregion, although floral and faunal influences occur west along the base of the Mogollon Rim and to the Prescott area as well. The largest extent in this ecoregion is on the San Carlos Indian Reservation, and a second area occurs in the vicinity of Eagle Creek and the San Francisco River.

This habitat type is found primarily in Apache Highlands South, with some representation at its northern limit in this ecoregion. The following major stressors were assessed for this habitat type in Apache Highlands South.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: Abiotic resource use
- Mining

Stressor Category: Changes in Ecological Processes
- Insect Infestation
- Habitat fragmentation/barriers
- Soil erosion
- Unnatural fire regimes
- Habitat degradation/shrub invasions

Stressor Category: Climate Change
- Shift to warmer climate
- Drought

Stressor Category: Consumptive use of biological resources
- Grazing by ungulates
- Harvesting/collecting animals

Stressor Category: Habitat conversion
- Livestock management
- Rural development

Stressor Category: Invasive species
- Feral animals
- Nuisance plants
- Disease/pathogens/parasites

Stressor Category: Non-consumptive resource use
- Motorized recreation off-trail
- Off-range recreational shooting
- Non-motorized recreation off-trail

Stressor Category: Transportation and infrastructure
- Roads for motorized vehicles
- Trails for foot, bike, or equine use
- Unauthorized roads & trails
- Right-of-way fencing along roadways

Upland Sonoran Desertscrub
(0.4% of acreage)

Habitat Condition (Element 2)
This habitat type is found primarily in the Sonoran Desert ecoregion; its largest extent in Apache Highlands North is in the Beaver Creek watershed. The condition of this landscape was well developed Sonoran Desertscrub habitat with very interspersed Semi-Desert Grassland prior to the settlement of the Verde Valley in the mid 1800s and is currently being heavily impacted by human development, dispersed recreation and water diversion. Important land use activities over this time frame have been livestock grazing, mining and limited agricultural development. Shifts in these activities, including reduced mining activities and rural development encroaching on the limited agricultural activities of the valley, have served to reduce the viability of this Sonoran desertscrub as wildlife habitat. Loss of springs and riparian zones have resulted from de-watering of most of the watershed for municipal and residential subdivision uses. The condition of the landscape is expected to decline further in the future with continued urbanization of the area, development of the remaining wildlands for activities such as golf resorts, recreation sites and the like. The stressors listed below reflect the pressures described above as well as changes to natural processes resulting from climate change and a resulting trend toward warmer conditions. Significant impacts from invasive species proliferation and introduction of nonnative plant and animal species will serve to continue the deterioration of this habitat type.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: Abiotic resource use
Groundwater depletion and springhead use
Stressor Category: Changes in Ecological Processes
Unnatural fire regimes
Soil erosion
Habitat fragmentation/barriers
Stressor Category: Climate Change
Drought
Shift to warmer climate
Stressor Category: Consumptive use of biological resources
Grazing by ungulates
Stressor Category: Invasive species
Disease/pathogens/parasites
Nuisance animals
Nuisance plants
Stressor Category: Non-consumptive resource use
Off-range recreational shooting
Motorized recreation off-trail
Stressor Category: Pollution

Illegal dumping/littering
Stressor Category: Transportation and infrastructure
Unauthorized roads & trails
Roads for motorized vehicles

Riparian and aquatic systems in Apache Highlands North

General Conditions and Trends in Riparian and Aquatic Systems

Riparian and aquatic systems in the Apache Highlands North have been uniformly impacted in dramatic fashion from the pre-settlement condition. Three major sources of impact account for most of the change in Apache Highlands North as well as across the state: prevailing drought, livestock management and the resulting impacts to riparian areas and watersheds, and introduction of nonnative organisms. Other factors causing significant local impact in this ecoregion include runoff from mining waste and road-building activities; off-road vehicular traffic along and across stream courses; changes to watercourses from diversion, impoundments, and beaver removal; and fire on watersheds resulting in high siltation.

Wetlands/Springs/Seeps

Habitat Condition (Element 2)

Wetlands, springs and seeps in the Apache Highlands North have been affected by drought, human modification, and over utilization of the riparian vegetation. Construction of concrete "spring boxes" has resulted in many springs becoming unavailable to support riparian communities at the margins. Long-term drought, combined with poor watershed condition, is causing many of these areas to go dry for the first time in recorded history.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: Abiotic resource use
Groundwater depletion and springhead use
Mining
Stressor Category: Changes in Ecological Processes
Habitat degradation/shrub invasions
Stressor Category: Climate Change
Drought
Shift to warmer climate
Stressor Category: Consumptive use of biological resources
Grazing by ungulates
Stressor Category: Habitat conversion
Livestock management
Urban growth
Dams/reservoirs/impoundments
Rural development

Agricultural conversion
Stressor Category: Invasive species
Nuisance animals
Nuisance plants
Disease/pathogens/parasites
Stressor Category: Non-consumptive resource use
Motorized recreation off-trail
Scientific research and collection
Stressor Category: Pollution
Nutrients/algal blooms
Sediment/ash flows
Contaminants from waste water and runoff
Pesticides/herbicides
Heavy metals/mine tailings
Stressor Category: Transportation and infrastructure
Canals/pipelines
Trails for foot, bike, or equine use
Roads for motorized vehicles
Unauthorized roads & trails

Streams/Rivers

Habitat Condition (Element 2)
Degraded conditions and trends in this ecoregion mirror those for the state as a whole. Many streams and rivers have become highly eroded, impacted by nonnative organisms, and converted to ephemeral flows as a result of erosion and general watershed degradation. Riparian tree communities have been greatly reduced in extent due to overgrazing of seedlings necessary for recruitment and by altered flow regimes that reduce or eliminate conditions necessary for seed germination and seedling establishment. Many land managers are moving toward active acceptance of responsibility to manage these impacts from livestock on riparian areas, so the trends for condition of riparian habitat may begin to see improvement. Nonnative aquatic organisms are having profound effects, however, and have eliminated or reduced native fish and aquatic invertebrates in many areas. Most waterways are under threat or have already been converted by crayfish to simple monocultures of crayfish and algae.

While impoundments and diversion of watercourses in the Apache Highlands North are not on the dramatic scale of the Sonoran Desert, the many small diversions and impoundments have served to dramatically change many watercourses from pre-settlement condition. Perhaps the most dramatic change has resulted from the removal of beaver from many systems. Early explorers found many beaver in the streams and wetlands of much of Arizona. These were profoundly reduced in the mid-1800s. Many watercourses apparently have changed as a result, with loss of more continuously connected wetland areas, increases in flow rate peaks, decreases in flow duration, and increases in both seasonal and area extent of periods of no flow. This has

had profound effects on riparian and aquatic plant communities and their associated wildlife. A perhaps direct result of this reduction in beaver modified habitat is the reduction in leopard frog populations throughout the state and region. Leopard frogs appear to be vulnerable to local extinctions. During periods of high wetland connectivity, frog metapopulations could survive with local extinctions being corrected by immigration of frogs from adjacent habitats. As watercourses became increasingly disconnected, local extinctions are less likely to be followed by recolonization.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: Abiotic resource use
Mining
Groundwater depletion and springhead use
Stressor Category: Changes in Ecological Processes
Management for game animals and sport fish
Habitat fragmentation/barriers
Altered river flow regimes
Habitat degradation/shrub invasions
Streambank alteration/channelization
Stressor Category: Climate Change
Shift to warmer climate
Drought
Stressor Category: Consumptive use of biological resources
Grazing by ungulates
Stressor Category: Habitat conversion
Recreational sites/facilities
Rural development
Agricultural conversion
Dams/reservoirs/impoundments
Landfills/dumps
Urban growth
Livestock management
Stressor Category: Invasive species
Nuisance plants
Bait-bucket dumping/illegal stocking
Disease/pathogens/parasites
Nuisance animals
Stressor Category: Non-consumptive resource use
Scientific research and collection
Motorized recreation off-trail
Stressor Category: Pollution
Sediment/ash flows
Pesticides/herbicides

Contaminants from waste water and runoff
Nutrients/algal blooms
Heavy metals/mine tailings
Stressor Category: Transportation and infrastructure
Unauthorized roads & trails
Roads for motorized vehicles
Trails for foot, bike, or equine use
Canals/pipelines

Lakes/Reservoirs

Habitat Condition (Element 2)
Lakes and reservoirs are not an important habitat type for wildlife in the Apache Highlands North, except for smaller human-created impoundments. These range from stock tanks of less than ½ acre in size up to local community/ranch ponds and small lakes. Most are dominated by nonnative fishes and have limited or no riparian areas associated with them. They do provide locally important sources of drinking water for many wildlife species, and indeed are frequently the only sources of standing water over significant areas.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: Abiotic resource use
Groundwater depletion and springhead use
Mining
Stressor Category: Changes in Ecological Processes
Management for game animals and sport fish
Habitat degradation/shrub invasions
Stressor Category: Climate Change
Shift to warmer climate
Drought
Stressor Category: Consumptive use of biological resources
Grazing by ungulates
Stressor Category: Habitat conversion
Agricultural conversion
Rural development
Livestock management
Urban growth
Landfills/dumps
Recreational sites/facilities
Dams/reservoirs/impoundments
Stressor Category: Invasive species
Disease/pathogens/parasites
Nuisance plants

Nuisance animals
Bait-bucket dumping/illegal stocking

Stressor Category: Non-consumptive resource use
Motorized recreation off-trail
Scientific research and collection
Watercraft operation

Stressor Category: Pollution
Pesticides/herbicides
Nutrients/algal blooms
Sediment/ash flows
Contaminants from waste water and runoff
Heavy metals/mine tailings

Stressor Category: Transportation and infrastructure
Trails for foot, bike, or equine use
Canals/pipelines
Unauthorized roads & trails
Roads for motorized vehicles

Stressors that act in this ecoregion at the species-but not habitat-scale (Element 3)

In some cases, a stressor may have significant impacts to individual SGCN, but impacts are not felt throughout the habitat. Regardless of the extent of ecosystem-wide impacts, in any habitat type where these stressors act on SGCN, the appropriate conservation actions apply (see "Conservation Actions to Address Stressors to SGCN (Elements 3, 4)"). The following stressors have significant ecosystem-level impacts in some habitat types in this ecoregion, but not in all habitat types where the SGCN occur. Note that for wide-ranging species, impacts from some stressors may be quite significant, but may not act on the species throughout its range.

Stressors that rated high for SGCN in Apache Highlands North, but not for the habitat type in which they occur.			
Stressor category	Stressor	Scientific name	Common name
Habitat conversion			
	Forest & woodland management - habitat conversion		
		Accipiter gentilis atricapillus	Northern Goshawk
		Catharus ustulatus	Swainson's Thrush
		Contopus cooperi	Olive-sided Flycatcher
		Picoides dorsalis	American Three-toed Woodpecker
	Livestock management		

Stressors that rated high for SGCN in Apache Highlands North, but not for the habitat type in which they occur.			
Stressor category	Stressor	Scientific name	Common name
		Buteogallus anthracinus	Common Black-Hawk
		Catharus ustulatus	Swainson's Thrush
		Haliaeetus leucocephalus	Bald Eagle
		Cynomys gunnisoni	Gunnison's Prairie Dog
		Panthera onca	Jaguar
	Recreational sites/facilities		
		Haliaeetus leucocephalus	Bald Eagle
		Microtus mexicanus hualpaiensis	Hualapai Mexican Vole
	Urban growth		
		Cynomys gunnisoni	Gunnison's Prairie Dog
Non-consumptive resource use			
	Dispersed camping		
		Buteogallus anthracinus	Common Black-Hawk
		Haliaeetus leucocephalus	Bald Eagle
	Off-range recreational shooting		
		Haliaeetus leucocephalus	Bald Eagle
Pollution			
	Lead shot/fishing line		
		Haliaeetus leucocephalus	Bald Eagle
	Pesticides/herbicides		
		Eumops perotis californicus	Greater Western Mastiff Bat
	Sediment/ash flows		
		Catharus ustulatus	Swainson's Thrush
		Haliaeetus leucocephalus	Bald Eagle
Changes in Ecological Processes			
	Altered river flow regimes		
		Eumops perotis californicus	Greater Western Mastiff Bat
Consumptive use of biological resources			
	Harvesting/collecting animals		
		Haliaeetus leucocephalus	Bald Eagle
		Panthera onca	Jaguar